

# WSDOT Interim Guidance for Crosswalk Rapid Flashing Beacon (RFB) Systems

Revision 1A

In response to the Federal Highway Administration (FHWA) termination of IA-11, Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons, the Washington State Department of Transportation (WSDOT) has chosen to utilize circular rapid flashing beacons (CRFBs) in place of rectangular rapid flashing beacons (RRFBs). Standard details have been developed and made available through the WSDOT website at <http://www.wsdot.wa.gov/Design/Standards/PlanSheet/IS-22.htm>.

## **Shape and Location of Beacons**

The shape and location of the beacons have been evaluated through existing research by the Texas Transportation Institute (TTI). TTI found that there was no significant difference in response to circular versus rectangular beacons, or by locating the beacons above the sign assembly as opposed to between the primary and supplemental signs, and is described in FHWA Report FHWA-HRT-15-043

(<https://www.fhwa.dot.gov/publications/research/safety/15043/index.cfm>). The study data appears to show slightly higher compliance with circular beacons, though not enough to be statistically significant. The study also noted lower closed course driver discomfort with the beacons placed above the signs. Placement of the beacons above the sign was sufficiently proven that FHWA issued Official Interpretation Letter 4(09)-58 (I) ([https://mutcd.fhwa.dot.gov/resources/interpretations/4\\_09\\_58.htm](https://mutcd.fhwa.dot.gov/resources/interpretations/4_09_58.htm)), allowing this placement.

## **Flash Pattern**

To allow for compliance with the MUTCD and FHWA guidance, WSDOT is requiring that all CRFB systems be capable of providing the following three flashing patterns: 50-50 “Wig-Wag” Pattern, WSDOT Interim Pattern, and “WW+S” Pattern. These patterns are described and explained below.

### 1. MUTCD Standard 50-50 “Wig-Wag” Pattern:

- The left beacon is ON and the right beacon is OFF for 0.5 seconds.
- The left beacon is OFF and the right beacon is ON for 0.5 seconds.
- Cycle repeats; cycle length is 1.0 seconds.

This is the standard pattern derived from MUTCD Section 4L.01, and is readily available for beacon and traffic signal systems.

### 2. WSDOT Interim Pattern:

- The left beacon is ON and the right beacon is OFF for 0.25 seconds.
- The left beacon is OFF and the right beacon is ON for 0.25 seconds.
- The left beacon is ON and the right beacon is OFF for 0.25 seconds.
- The left beacon is OFF and the right beacon is ON for 0.25 seconds.
- The left beacon is ON and the right beacon is OFF for 1.00 seconds.
- The left beacon is OFF and the right beacon is ON for 1.00 seconds.
- Cycle repeats; cycle length is 3.00 seconds.

This pattern was developed by WSDOT in an effort to provide an MUTCD compliant pattern similar to the already proven “WW+S” pattern, while avoiding flash rates of concern for potential epileptic responses.

This pattern complies with the MUTCD requirement that the flash rate be not less than 50 or more than 60 times per minute for each beacon, as each beacon flashes 3 times for every 3 second cycle, or 60 times per minute. This pattern also complies with the requirement that the illuminated period of each flash be a minimum of 1/2 and a maximum of 2/3 of the total cycle, as each beacon is on for 1/2 of the cycle length at 1.5 seconds of the 3 second cycle length and 30 seconds out of every 60 seconds.

Additionally, this pattern provides an irregular sequence, which appears to provide better responsiveness than fixed 50-50 wig-wag flashing lights, while still abiding by the recommendations of the Epilepsy Foundation that flashing light sequences operate at 2 flashes per second or less (2 Hz) and include periodic longer breaks rather than a continuous flash cycle.

Regardless of technical compliance, FHWA has issued an Official Interpretation (Interpretation Letter 4(09)-64 (I); [https://mutcd.fhwa.dot.gov/resources/interpretations/4\\_09\\_64.htm](https://mutcd.fhwa.dot.gov/resources/interpretations/4_09_64.htm)), stating their interpretation that this pattern does not comply with paragraph 3 of Section 4L.01 of the MUTCD.

### 3. “WW+S” Pattern:

- The left beacon is ON and the right beacon is OFF for 0.05 seconds.
- Both beacons are OFF for 0.05 seconds.
- The left beacon is OFF and the right beacon is ON for 0.05 seconds.
- Both beacons are OFF for 0.05 seconds.
- The left beacon is ON and the right beacon is OFF for 0.05 seconds.
- Both beacons are OFF for 0.05 seconds.
- The left beacon is OFF and the right beacon is ON for 0.05 seconds.
- Both beacons are OFF for 0.05 seconds.
- Both beacons are ON for 0.05 seconds.
- Both beacons are OFF for 0.05 seconds.
- Both beacons are ON for 0.05 seconds.
- Both beacons are OFF for 0.25 seconds.
- Cycle repeats; cycle length is 0.80 seconds.

This pattern was developed by TTI as part of research on behalf of FHWA, and is discussed in FHWA Techbrief FHWA-HRT-15-041

(<https://www.fhwa.dot.gov/publications/research/safety/15041/index.cfm>) as having

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been developed in a workshop conducted as part of this research. The findings of the research were sufficient for FHWA to favor the “WW+S” pattern, as noted in the research document and through Official Interpretation Letter 4(09)-41 (I) ([https://mutcd.fhwa.dot.gov/resources/interpretations/4\\_09\\_41.htm](https://mutcd.fhwa.dot.gov/resources/interpretations/4_09_41.htm)).

## **Conclusion**

WSDOT’s CRFB system meets all current equipment requirements and can be constructed with readily available parts from multiple manufacturers. The equipment specifications do not require a specific method of power or connection between units, allowing for multiple methods of accomplishing either. The only item of concern is the operating flash pattern.

WSDOT would prefer to implement the “WW+S” pattern developed by TTI, but this pattern does not meet current MUTCD requirements or any Interim Approvals or similar documents currently in effect. WSDOT will continue to evaluate potential alternatives in an effort to provide a pattern that is compliant with requirements in effect while still providing a level of effectiveness similar to the “WW+S” pattern.

WSDOT is limiting its direction to requiring that these three patterns, at a minimum, be available for use as part of any CRFB system and selectable by the end user in the field. The pattern used in the field is left at the discretion of the end user. The inclusion of the three patterns ensures that at least one compliant pattern is available, and allows for simple conversion in the future to the “WW+S” pattern if/when it becomes permissible to use again for RFB systems.

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## **References:**

FHWA Interim Approval IA-11:

[https://mutcd.fhwa.dot.gov/resources/interim\\_approval/ia11/fhwamemo.htm](https://mutcd.fhwa.dot.gov/resources/interim_approval/ia11/fhwamemo.htm)

FHWA Interpretation Letter 4(09)-41 (I), Additional Flash Pattern for RFBs:

[https://mutcd.fhwa.dot.gov/resources/interpretations/4\\_09\\_41.htm](https://mutcd.fhwa.dot.gov/resources/interpretations/4_09_41.htm)

FHWA Interpretation Letter 4(09)-58 (I), Placement of RFB Units above Sign:

[https://mutcd.fhwa.dot.gov/resources/interpretations/4\\_09\\_58.htm](https://mutcd.fhwa.dot.gov/resources/interpretations/4_09_58.htm)

FHWA Interpretation Letter 4(09)-64 (I), Flash Rate for Traffic Control Signals and Beacons:

[https://mutcd.fhwa.dot.gov/resources/interpretations/4\\_09\\_64.htm](https://mutcd.fhwa.dot.gov/resources/interpretations/4_09_64.htm)

FHWA Termination of Interim Approval IA-11:

[https://mutcd.fhwa.dot.gov/resources/interim\\_approval/ia11/terminationmemo/index.htm](https://mutcd.fhwa.dot.gov/resources/interim_approval/ia11/terminationmemo/index.htm)

MUTCD Chapter 4L: <https://mutcd.fhwa.dot.gov/html/2009r1r2/part4/part4l.htm>

TRB Journal 2073-08, Stutter-Flash Light-Emitting-Diode Beacons to Increase Yielding to Pedestrians at Crosswalks: <http://trrjournalonline.trb.org/doi/abs/10.3141/2073-08>

Epilepsy Foundation Recommendations regarding Photosensitivity and Seizures:

<https://www.epilepsy.com/learn/triggers-seizures/photosensitivity-and-seizures>

FHWA Report FHWA-HRT-15-043, Investigating Improvements to Pedestrian Crossings with an Emphasis on the Rectangular Rapid-Flashing Beacon,

<https://www.fhwa.dot.gov/publications/research/safety/15043/index.cfm>

FHWA Techbrief FHWA-HRT-15-041, Comparison of Driver Yielding for Three Rapid-Flashing Patterns Used With Pedestrian Crossing Signs,

<https://www.fhwa.dot.gov/publications/research/safety/15041/index.cfm>

FHWA Report FHWA-HRT-16-040, Evaluation of Pedestrian Hybrid Beacons and Rapid

Flashing Beacons, <https://www.fhwa.dot.gov/publications/research/safety/16040/index.cfm>